Applied!

Computer Networks

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Cloud Computing

Personal Computer

- A personal computer (PC) is a computing device designed for individual use.
- It is typically used for a variety of tasks, including word processing, internet browsing, gaming, multimedia, and software development.

Types of Personal Computers

- **Desktop Computers**
- **Laptops**
- **Tablets**
- **All-in-One PCs**: These combine the monitor and computer components into a single unit, saving space and reducing cable clutter.
- Which one is better?

Servers

- Servers are powerful computers or systems designed to manage, store, send, and process data, serving multiple clients or users over a network.

Server OS

- A server operating system (OS) is a specialized operating system designed to manage server hardware and provide services to client devices over a network.
- Server OSs are optimized for performance, security, and reliability, making them suitable for handling multiple simultaneous requests and managing resources efficiently.
- Example:
  - Windows server 2003, 2008, 2008R2, 2012,2016,2019,2022
  - Linux: Debian, Ubuntu, Red Hat, CentOS

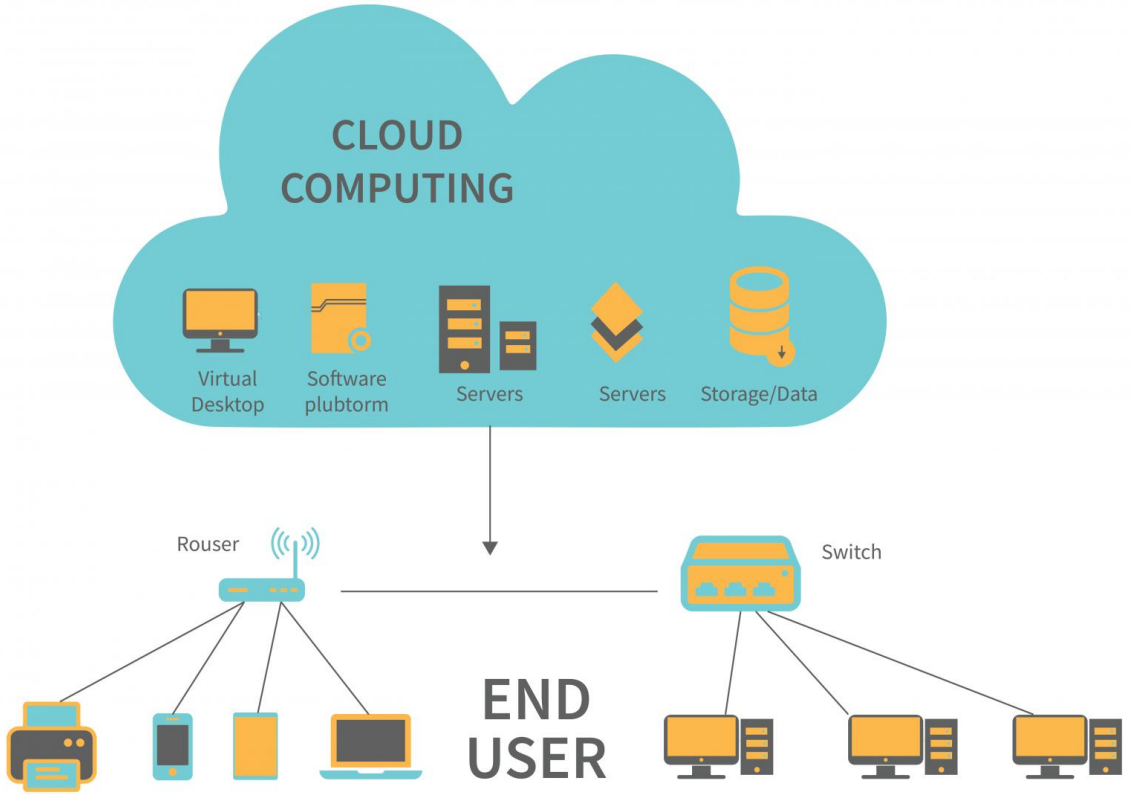
Windows Server

Servers in rack

- Server room
- Problems?

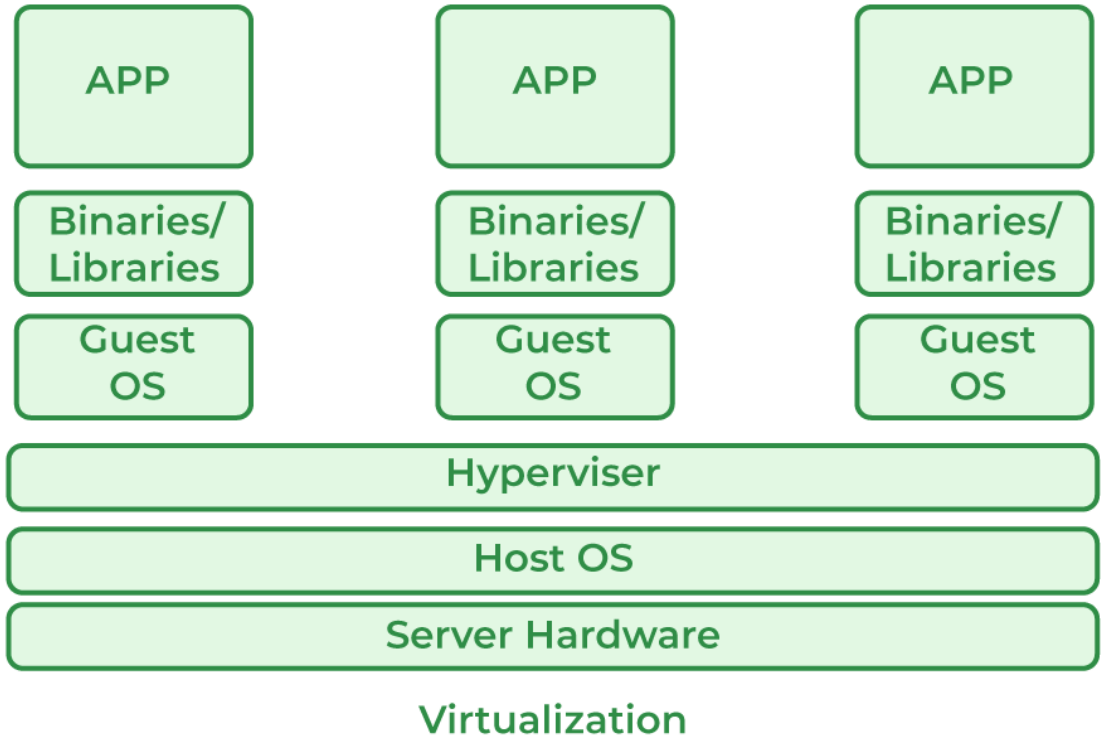
Cloud Computing

- Cloud computing is the delivery of computing services over the internet or Network.
- Allowing users to access and use resources such as servers, storage, databases, networking, software without the need for physical infrastructure.

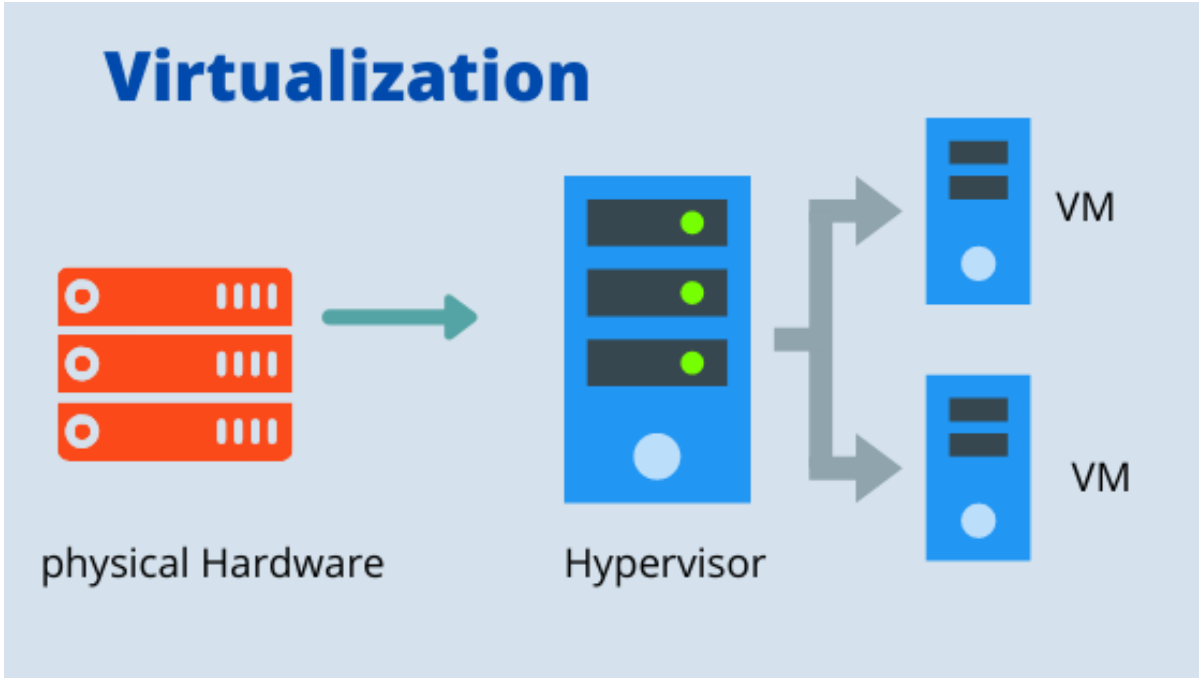


Virtualization

- Virtualization is a technology that allows multiple virtual instances of operating systems or applications to run on a single physical hardware system.
- It abstracts the physical hardware, enabling more efficient resource utilization, improved scalability, and easier management.



Virtualization



Benefits of Virtualization

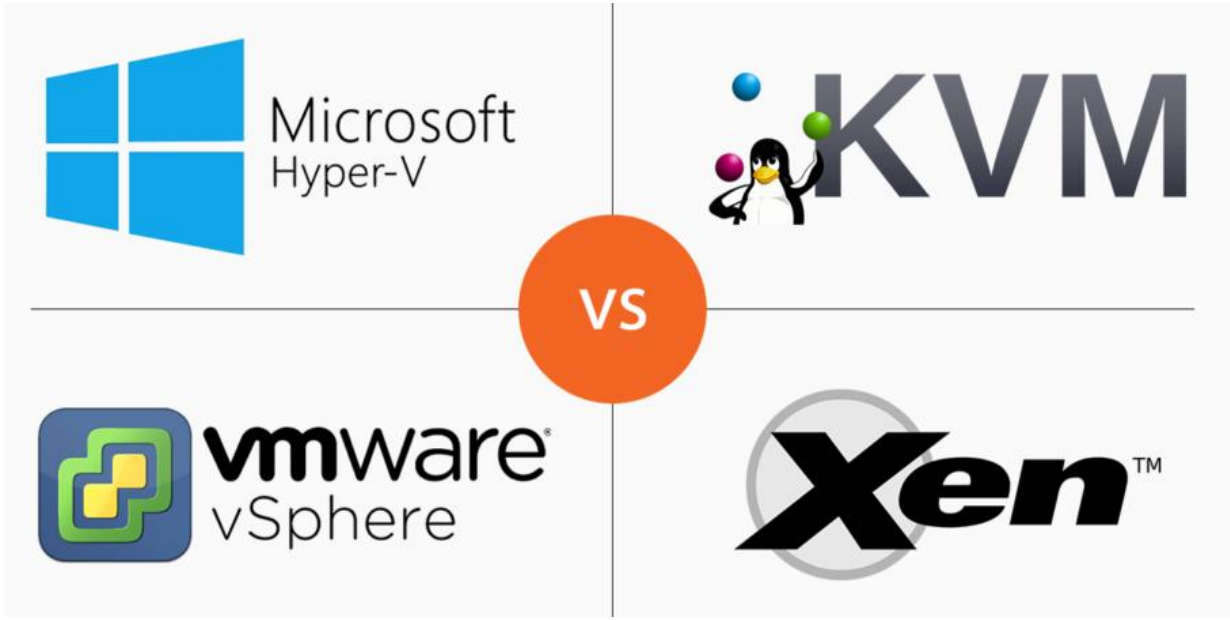
- **Resource Efficiency**: Maximizes the utilization of physical hardware by running multiple virtual instances on a single server, reducing hardware costs.
- **Scalability**: Easily scale resources up or down by adding or removing virtual machines as needed, allowing for quick adjustments to changing workloads.
- **Disaster Recovery**: Simplifies backup and recovery processes, as virtual machines can be easily copied, moved, or restored.
- **Testing and Development**: Provides a safe environment for testing new applications or configurations without affecting the production environment.

Challenges of Virtualization

- **Complexity**: Managing a virtualized environment can be complex, requiring skilled IT personnel to configure and maintain the infrastructure.
- **Performance Overhead**: While virtualization improves resource utilization, it can introduce some performance overhead due to the abstraction layer.
- **Licensing Costs**: Some virtualization solutions may involve licensing fees, which can add to overall costs.
- **Security Risks**: Virtual environments can be targets for attacks, and vulnerabilities in the hypervisor can potentially affect all virtual machines running on it.

Popular Virtualization Solutions

- **VMware vSphere (ESXi)**: A leading virtualization platform for server virtualization.
- **Microsoft Hyper-V**: A hypervisor included with Windows Server for creating and managing virtual machines.
- **KVM (Kernel-based Virtual Machine)**: An open-source virtualization solution integrated into the Linux kernel.



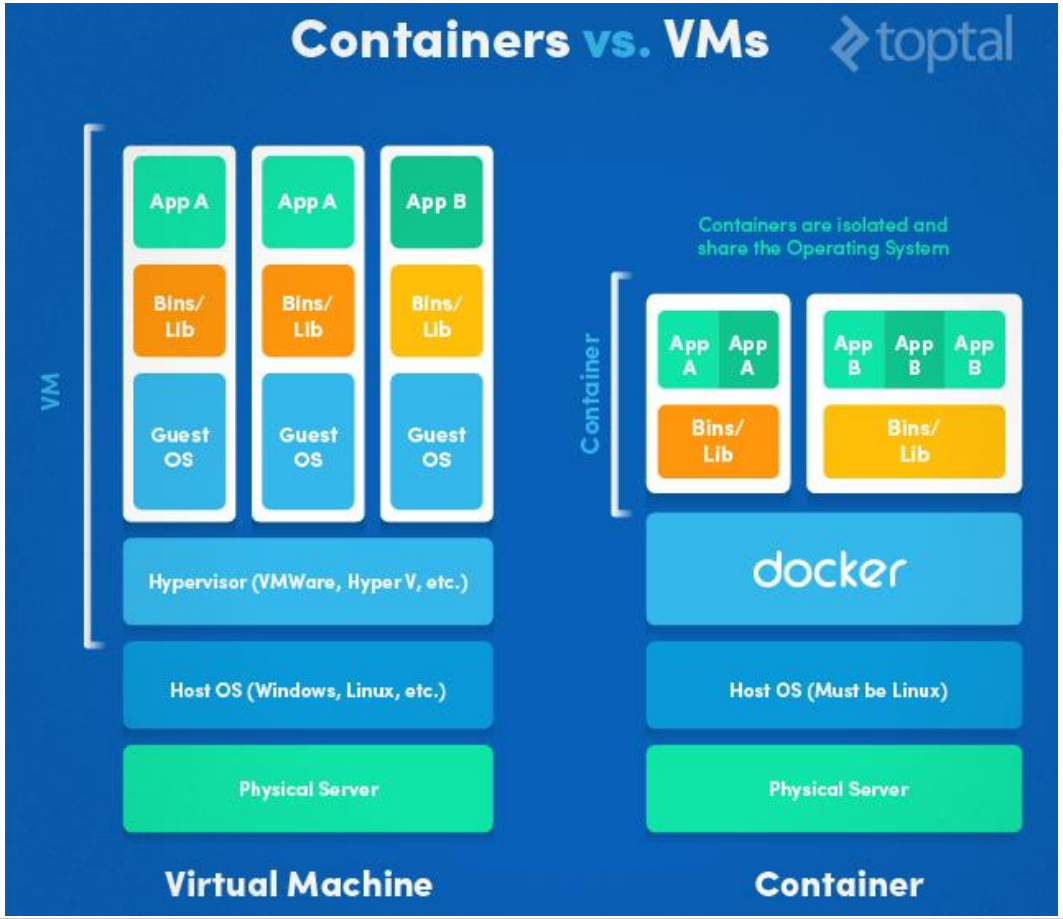
Demo

- Private Claude demo
- Migrate VM
- Extend VM resources
- Monitoring
- Backup/Restore

Containers

Containers

- Containers share the host operating system's kernel and run as isolated processes in user space.
- They package the application and its dependencies, but not the entire operating system.



Resource Utilization

- **Containers**:
  - Containers are more efficient in terms of resource usage since they share the host OS kernel.
  - They typically consume less memory and storage, making them ideal for microservices and cloud-native applications.
- **Virtual Machines**:
  - VMs require more resources because each VM runs its own operating system. This can lead to higher overhead in terms of CPU, memory, and storage.
  - VMs are generally less efficient in resource utilization compared to containers, especially when running many instances.

Isolation

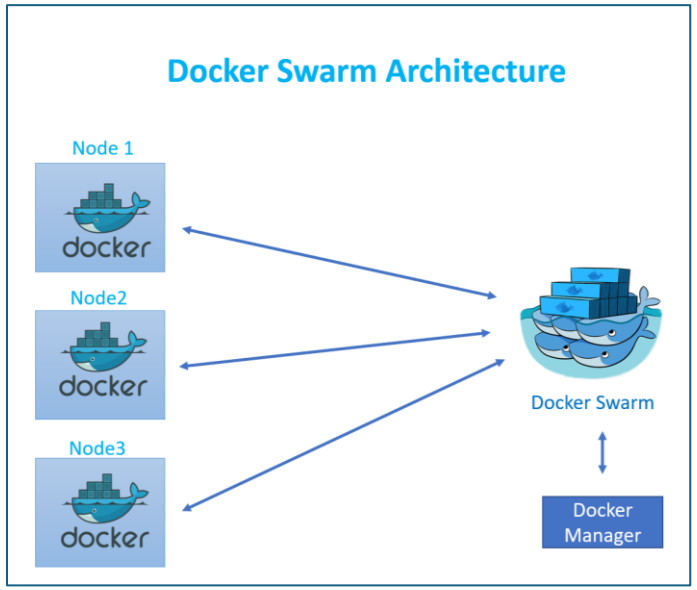
- **Containers**:
  - Containers provide process-level isolation, which is generally sufficient for many applications.
  - Since they share the host OS kernel, they may be more vulnerable to certain types of security risks if not properly managed.
  - They are suitable for applications that require fast scaling and deployment.
- **Virtual Machines**:
  - VMs provide stronger isolation since each VM runs a separate operating system. This makes them more secure in scenarios where complete isolation is required.
  - They are often used for running different operating systems on the same hardware or for applications that require a high level of security.

Performance

- **Containers**:
  - Containers typically have lower overhead and faster startup times, making them ideal for applications that need to scale quickly or require rapid deployment.
  - They are well-suited for microservices architectures and continuous integration/continuous deployment (CI/CD) pipelines.
- **Virtual Machines**:
  - VMs have higher overhead due to the full OS, which can lead to slower performance and longer boot times.
  - They are often used for legacy applications or scenarios where complete OS functionality is required.

Management

- **Containers**:
  - Managed using container orchestration tools like Kubernetes, Docker Swarm, or OpenShift.
- **Virtual Machines**:
  - Managed using hypervisors like VMware vSphere, Microsoft Hyper-V, or KVM, which provide tools for managing VM lifecycle, resource allocation, and networking.




YOU'RE PRETTY NEW TO CLOUD STORAGE, AREN'T YOU?
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